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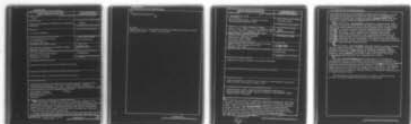
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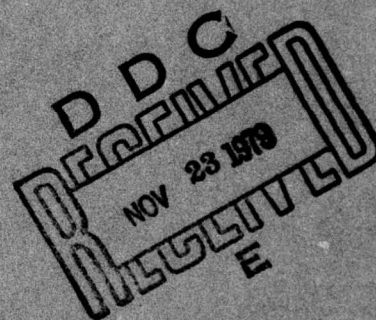
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PHYSICAL ENVIRONMENTS, HABITABILITY PERCEPTIONS, AND HEALTH

E. K. E. GUNDERSON

REPORT NO. 74-58



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⑥ PHYSICAL ENVIRONMENTS, HABITABILITY PERCEPTIONS, AND HEALTH,

⑩ E. K. Eric Gunderson

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The physical environment is viewed as an important component of the social system model. The environment has an impact at several levels of analysis and interacts with all other components to influence behavioral outcomes.

Reference to the external physical environment in the model indicates that an organization is an integral part of an ecological system and is affected by the surrounding natural terrain, climate, hazards, atmospheric pollutants, noise, energy and power sources, transportation systems, neighboring buildings and structures, nearby community facilities, and many other geographical and environmental factors.

The organizational physical environment consists of the buildings, structures, and the interconnecting or contiguous spaces where the organization's business is conducted and normal activities are carried out.

The group physical environment refers to the space occupied or used by a particular subunit of the organization. Aboard ship, work spaces or sleeping compartments are examples of this level or unit of analysis.

The environmental dimensions that are commonly applied to the description of organizational or group physical environments include: spatial size, temperature, ventilation, noise, illumination, color, cleanliness, odor, design of fixtures and furnishings, privacy, storage space, and safety factors.

These dimensions can be used to characterize the organizational environment as a whole, or, if significant variability is present, to differentiate among work areas or spaces within the total organizational environment. Most of these environmental dimensions can be assessed directly by measurements or objective ratings and comparisons.

Another approach to assessing environmental dimensions involves ratings by the inhabitants or occupants of the spaces. These habitability perceptions partly reflect attributes of the "real world" and partly reflect psychological processes within the individual. We have used both of these methods of assessing environments in our shipboard studies. In this paper I shall be primarily concerned with crew members' perceptions of their working and living conditions.

The major environmental dimensions and response categories used to describe shipboard living and working conditions are shown in Table 1 of the handout. This example applies to the crew member's work area; similar scales were provided for the individual to rate his berthing (sleeping) area, messing (eating) area, head (bathroom) facilities, and the ship as a whole. The crew member also was asked to rate how important each of the environmental factors was to him personally. These items were included in the Habitability and Shipboard Climate Questionnaire which was administered to approximately 70 to 80 percent of the crew members of the ships early in their overseas deployments.

The following dimensions were combined for purposes of estimating conditions on the ship as a whole: temperature-ventilation, cleanliness-odor, size-number of people, and lighting-color. The remaining dimensions --

privacy, noise, and safety -- were treated as separate variables. Individual scores were obtained for each of the seven habitability scales by summing response values for the four specific areas mentioned above and for the entire ship. Thus, the individual's score for the size-number of people composite represented his perceptions of crowding in the spaces that he occupied on the ship.

Table 2 of your handout shows a classification of ships by age and physical characteristics and the mean perceived habitability scores for the 15 ships included in the grouping. The four categories of ships reflect similarities in ship type, physical size and tonnage, dates of commissioning and conversion, structural design or class, and habitability characteristics.

The ships in Class A were all destroyers commissioned in 1945 and 1946. The basic hull design, structural configuration, and crew accommodations are typical of destroyers built during World War II, based upon the technology and habitability concepts of the late 1930's and early 1940's. Although "modernized" in 1960, this conversion was directed primarily toward modernizing weapons and electronics systems. The mess, berthing, and sanitary facilities remained essentially the same except that air-cooling units were installed in messing and berthing areas.

Ships in Class B were guided missile destroyers of the same class built in 1963-1964, and ships in Class C were guided missile frigates of the same vintage, but somewhat larger than the destroyers. The ships in Classes B and C, when compared with ships in Class A, incorporated some advances in habitability design. The ships in Group D were all destroyer-escorts of the same class and were among the most modern U.S. combat ships afloat.

Crew sizes ranged from approximately 220-270 men for the destroyers and destroyer-escorts to about 350-390 for the frigates.

Of the 20 ships in the total sample studied, three (a destroyer, a guided missile destroyer, and a destroyer-escort) did not fall within the specific classes represented by the four subgroups, and these ships were omitted from the comparisons below. Also, two aircraft carriers in the total sample were omitted from consideration.

Table 2 shows the arrays of mean perceived habitability scores by ships and by dimensions. There was virtually no overlap in mean scores from one ship class to another on the crowding and privacy dimensions. The mean crowding score for the least crowded ship (26.8) was more than one and one-half standard deviations higher (more favorable) than that for the most crowded ship (18.3).

On the other dimensions there tended to be some overlap from one ship class to another, but generally more favorable perceptions of habitability were typical of the newer ships. Thus, Class A ships were perceived as being hot, dirty, crowded, and unsafe compared with Class D ships.

Illness data were collected throughout the 7-8 months of the overseas deployments using individual cards which contained identifying information, type of illness, and disposition. These special illness records, instituted for the purpose of this research project, were accumulated to provide illness criterion information for individuals, work groups, berthing compartment occupants, and ships.

Table 3 provides an analysis of differences between ship classes on habitability scales and on illness criteria. Analysis of variance results are

presented in terms of the variance accounted for between ship classes as compared with the variance remaining among ships within classes. For the habitability dimensions it is clear that differences between classes tend to be large and to account for a large share of the total variance among ships. This result indicates a high degree of consensus as to physical environmental differences between the ship classes and suggests that the perceived habitability scores reflect real attributes of the shipboard environment.

Differences in illness rates were accounted for to some extent by differences between ship classes, but this effect was much less pronounced for illnesses than for habitability perceptions. Gastrointestinal disorders had the strongest association with ship class, that is, poor habitability conditions (presumably sanitation, etc.), and this relationship was linear. Dermatological conditions also were more common on Class A ships than other ships, and the total illness rate (excluding genitourinary or V.D. cases) was highest for the Class A ships.

Respiratory illnesses did not conform to the general pattern of other types of illness in that the newest ships (Class D) had the highest rate of respiratory infections while Class B ships had the lowest rate. At the same time it is noted that the Class D ships, which had central air-conditioning with recycled air, were most comfortable. The relationship between type of ventilation system and respiratory illness is being investigated further in a special study of seven of the ships in the sample: it is apparent that there is no simple relationship.

In the next step of the analysis, perceived habitability scores were correlated with the illness criteria with the between-ship-classes portion of

the variance removed. Using this procedure, temperature-ventilation, cleanliness-odor, noise, safety, light-color, and total habitability score, which was a summation of dimension scores, correlated significantly in the expected direction with the total illness criterion. In other words, the remaining variance in habitability perceptions within ship classes contributed further to the prediction of illness, although these correlations were low (about .10).

These results suggest that differences in actual physical characteristics of ships and differences in perceived habitability both contribute in small degree to the prediction of illness.

In the earlier pilot study of 1,200 men on 13 ships significant differences in perceived organizational climate were found among three types of ships.¹ Profiles of scores on five factors of organizational climate -- friendliness and warmth of the work environment, job identification, leadership effectiveness, group homogeneity, and job standards and demands -- were found to be related to differences in ships in relation to their location (overseas or continental U.S.), illness rates, and performance indices. A pattern of organizational climate was found which was associated with high illness and accident rates, high disciplinary rates, and low rate of intention to reenlist.

One of our objectives as stated earlier is to specify the portions of criterion variance accounted for by various major components of the model -- physical environment, perceived habitability, organizational structure, perceived organizational climate, individual resources -- and by interactions of these components. We have already shown that certain of the major model components -- physical environment, habitability perceptions, and organizational

climate -- separately make contributions to the prediction of such criteria as illness and job satisfaction. We now have the difficult task of integrating all of this data in order to support or refute major propositions implicit or explicit in our social systems model.

References

1. Jones, A. P., James, L. R., Hornick, C. W., and Sells, S. B.
Organizational Climate Related to Shipboard Functioning: A Preliminary Study.
Fort Worth: Institute of Behavioral Research Technical Report No. 73-16,
Texas Christian University, 1973.

Table 1

Habitability Dimensions

"FOR EACH OF THE CONDITIONS BELOW, CHOOSE THE LETTER WHICH COMES CLOSEST TO DESCRIBING THE WAY THINGS ARE IN YOUR WORKING AREA."

LIGHTING - - - - -	<u>TOO DIM</u>	a	b	c	d	<u>TOO BRIGHT</u>
		a	b	c	d	e
TEMPERATURE - - - - -	<u>HOT</u>	a	b	c	d	<u>COLD</u>
		a	b	c	d	e
VENTILATION - - - - -	<u>POOR</u>	a	b	c	d	<u>GOOD</u>
		a	b	c	d	e
CLEANLINESS - - - - -	<u>DIRTY</u>	a	b	c	d	<u>CLEAN</u>
		a	b	c	d	e
ODOR - - - - -	<u>UNPLEASANT</u>	a	b	c	d	<u>PLEASANT</u>
		a	b	c	d	e
SIZE - - - - -	<u>CRAMPED</u>	a	b	c	d	<u>ROOMY</u>
		a	b	c	d	e
NUMBER OF PEOPLE - - - - -	<u>CROWDED</u>	a	b	c	d	<u>UNCROWDED</u>
		a	b	c	d	e
COLOR - - - - -	<u>UNPLEASANT</u>	a	b	c	d	<u>PLEASANT</u>
		a	b	c	d	e
PRIVACY - - - - -	<u>NONE</u>	a	b	c	d	<u>PLENTY</u>
		a	b	c	d	e
NOISE - - - - -	<u>EXTREMELY DISTURBING</u>	a	b	c	d	<u>NOT BOTHERSOME</u>
		a	b	c	d	e
SAFETY - - - - -	<u>HAZARDOUS</u>	a	b	c	d	<u>SAFE</u>
		a	b	c	d	e

Table 2

Ship Characteristics and Mean Perceived Habitability Scores

	Class A Destroyers			Class B Missile Destroyers				Class C Missile Frigates			Class D Destroyer Escorts				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Commissioning/ Conversion dates	1945/ '59-60	1946/ '59-60	1945/ '59-60	1964	1963	1963	1964	1963	1966	1964	1970	1970	1970	1970	1970
<u>Habitability Dimensions^a</u>															
Crowding ^b	18.3	19.7	20.3	20.6	21.2	21.3	22.0	22.0	23.7	24.1	24.1	25.2	26.2	26.7	26.8
Temperature-	20.9	21.2	24.5	21.4	21.3	23.2	18.5	24.1	25.6	23.5	26.9	22.9	25.2	24.4	27.2
Ventilation															
Cleanliness-	26.5	25.7	25.7	26.2	26.3	27.9	26.1	27.4	28.9	27.2	29.5	27.3	29.6	30.3	30.9
Odor															
Noise	11.5	12.7	12.7	12.4	12.1	12.8	12.7	11.7	12.5	12.0	13.4	13.3	13.3	14.0	13.8
Safety	14.1	15.4	14.9	14.4	15.0	15.5	15.8	15.7	16.0	16.0	16.5	16.2	16.7	17.3	17.1
Privacy	6.4	6.7	6.6	6.7	7.1	7.1	7.3	7.5	7.5	7.4	8.0	8.8	8.5	8.5	8.9
Light-Color	25.7	25.3	26.0	26.2	25.3	25.0	26.5	25.7	25.8	26.8	26.5	27.4	28.1	27.5	28.4

^aIndividual scores were obtained by summing responses for each habitability dimension over five ship areas: working area, messing area, berthing area, heads or sanitary facilities, and the entire ship. Mean scores were then obtained for all crew members tested on each ship.

^bCombines "Size" and "Number of People" items.

Table 3

Ship Class Means and ANOVA Results for Habitability Scores and Illness Criteria

<u>Habitability Dimensions:</u>	<u>Mean Habitability Scores^a</u>				<u>ANOVA Results</u>	
	<u>Class A</u>	<u>Class B</u>	<u>Class C</u>	<u>Class D</u>	<u>Between Ship Classes^b</u>	<u>Within Ship Classes^b</u>
Crowding	19.3	21.2	23.1	25.6	83.2	5.6
Temperature-Ventilation	22.7	20.8	23.7	25.2	52.8	14.4
Cleanliness-Odor	26.1	26.5	27.3	29.3	26.2	4.6
Noise	12.1	12.5	11.9	13.6	23.0	2.1
Safety	14.5	15.2	15.9	16.7	25.6	3.1
Privacy	6.5	7.0	7.4	8.5	45.2	1.9
Light-Color	25.8	25.9	26.3	27.4	9.0	2.7
Total Habitability	127.2	128.7	135.8	146.0	58.7	2.9
<u>Illness Criteria:^c</u>						
Respiratory	5.0	4.2	5.4	6.0	12.0	11.9
Dermatology	4.1	2.8	2.9	3.0	4.2	3.9
Trauma	2.1	2.0	2.1	1.7	1.5	5.7
Gastrointestinal	3.5	2.8	2.0	1.5	19.7	10.8
Total Illness ^d	18.2	15.0	17.3	15.1	5.3	13.9

^aHigh scores indicate favorable habitability^bF-ratios; df between classes equals 3 and df within classes equals 8.^cThe number of initial dispensary visits per 1,000 men per day. One ship was dropped from Class A, Class C, and Class D because of incomplete illness reporting.^dGenitourinary infections were not included.

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(IBR) Report 74-28. Forth Worth: Institute of Behavioral Research, Texas
Christian University. October 1974, pp 43-54

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18. SUPPLEMENTARY NOTES Papers presented in a symposium at the American Psychological Association annual meeting, New Orleans, August, 1974.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Organizational climate, Organizational structure, Habitability, Organizational Model, Health, Intent to Reenlist, Psychological Climate, Organizational Performance		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This symposium presented the background, underlying assumptions, philosophy and goals, research design, sample, and results of an intensive three-year organizational study involving military, government and civilian organizations. The first paper by S. B. Sells , discussed the organizational setting, approach, and rationale of this research, which embraced both macro- and micro-aspects of organizational situations, the characteristics of organizational subsystems, and the effects of organizational		

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structures and events upon individual attitudes and performance. At the level of practical goals, all effort has been made to explain various differences in health rates within and across classes of ship, that were found in a previous study of illness rates at U.S. Navy installations.

The second paper, by ~~L. R. Jones~~, presented an organizational model developed to guide the investigation and specific analyses in the present study. The model combines an open systems approach with a linkage model, and embraces a number of major facets of organizational functioning (Context, structure, values, processes) and organizational levels (external environment, total organization, subsystems, and groups). In addition, individual characteristics and intervening variables such as perceived organizational climate occupy significant roles in the model. This paper presented data on reliability, item analysis and dimensionality of an organizational climate questionnaire, as well as measures of structure and other organizational characteristics.

The third paper, by ~~A. P. Jones~~, presented empirical evidence bearing upon the theoretical model. Analyses addressed relationships among variables within basic organizational or subsystem components (between structural variables), across components but within particular levels of analysis, across components and across levels, and finally predictive relationships with individual and organizational criteria.

The paper by ~~E. R. E. Gunderson~~ discussed aspects of the physical environment and their relationship to perceptions of the environment and to behavioral outcomes such as illnesses and accidents. Several environmental dimensions have been isolated and were related to differences in organizational units and to differences in illness and injury rates. Environmental characteristics were shown to affect health, job satisfaction, and work efficiency and to be separate from the effects of individual characteristics or organizational climate.

The discussants, Paul Nelson and B.V. H. Gilmer reviewed the study in terms of both its applied and theoretical implications.